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INFORMATION ON TECHNICAL PROGRESS IN USSR COAL INDUSTRY

[Comment: This report gives in full the table of contents of Tekhnicheskiy Progress v Ugol'nov Promyshlennosti by G. V. Krasnikovskiy, Moscow, 1954. In addition, it includes complete translations of Chapters 3, 5, and 11, and certain statistical data from other chapters of the book.]

1. TABLE OF CONTENTS OF TEKHNICHESKIY PROGRESS V UGOL'NOY PROMYSHLENNOSTI

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Mechanization of Operations at the Surface of Mines

Coal Cleaning

Development of Scientific Research Work

II. IMPROVEMENT OF METHODS OF WORKING COAL DEPOSITS

The rapid development of the coal industry, the exploitation of new coal regions, complicated conditions of working coal seams, the technical reequipment of mines, the spread of mechanization of all productive processes, increased demands of safety operations -- all these factors present workers of the coal industry with a number of complicated technical questions and problems.

The first necessities are to make certain that methods and systems of working conform to the achieved technical level of coal extraction and to search for the most efficient methods of opening up and developing coal seams.

New extraction and transport machinery and mechanisms differ sharply from those formerly used, both in method of operation and in capacity. They require for their effective utilization a suitable work front, alterations in planning of mining operations, and suitable size of freight flows.

At present, the necessary correspondence between new means of mechanization and forms of organization of production, on the one hand, and mining operations, on the other, does not exist in the majority of coal basins. Particularly, it is lacking in the largest and most mechanized basin, the Donbass. Despite the fact that the introduction of new techniques and the cycle organization of production started in the Donbass, the planning of mine workings and systems of working have changed hardly at all in that area during recent years. New mining machines and the cycle organization of work have been introduced but the old systems of working and planning were continued. This led to a gap between new technical means and forms of organization of production and conditions for utilizing them.

Use of New Machines Hindered

This gap makes it impossible to use such new devices as loading machines to capacity. These machines assure a high rate of speed in cutting mine workings, and their use eliminates the gap in the mechanization of extraction and development work. However, in the continuous method of working seams and in the advancing method of working mine fields (from the mine shaft to the limits of the mine field), the advance of the workings, where these machines are used, is determined entirely by the rate of advance of the line of the face. This interferes with the productive use of loading machines in development workings.

To assure the productive work of coal combines, the continuous arrival of empty cars is necessary at the loading point beneath the face. With the continuous system of mining, fulfillment of this requirement is difficult since loading of coal from the face is carried out in the same haulage passage as other operations connected with the cutting of the passage. As a result of the lack of promptness in delivery of empty cars and removal of loaded ones, the combines experience idle periods. It is also difficult to supply the working front of the passage with empty cars. Because of delays in the delivery of empty cars, loading machines are idle even more frequently

and longer than combines at the faces. All this makes it difficult to carry out cycle schedules at faces and reduces the effective use of combines.

The continuous system of mining and the advancing method of working mine fields make it impossible to establish beforehand, in adequate detail, the character of the lay of the coal seams. As a result, frequent instances occur in which the faces are at a standstill or actually go out of operation. The continuous system of mining and, in connection with this, the small freight flows in haulage passages and slopes, interfere with productive utilization of the new means of transportation.

System of Mining Reviewed

All these circumstances caused a review of the question of systems of mining and led to a plan for a radical reorganization of mining economy in the near future. The principal trend of such a reorganization is the conversion to the long-pillar system and the working of mine fields by the retreat method (from the limits of the mine field to the mine shaft). These changes will facilitate better organization of production, improve utilization of machinery, lead to continuous loading of coal, permit determination in advance of possible disruptions in the lay of the seams, and eliminate unexpected shutdowns of the faces. Introduction of the new system will assure regular operation of the mines, increase the coal yield from the extraction faces, and raise labor productivity of all workers in the mine.

However, the execution of planned operations for improving the mining system faces a number of serious difficulties. Reorganization of mining operations is complicated by the fact that it is supposed to be carried out in working mines simultaneously with the extraction of coal. In addition, the conversion to the retreat method of working mine fields necessitates preliminary development work to the limits of the mine field. This means a considerable extra volume of cutting operations.

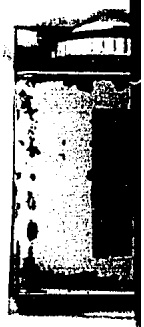
The designing and introduction of development work combines is one of the first conditions which must be fulfilled to carry out the program.

III. PROPPING OF MINE WORKINGS AND ROOF CONTROL IN MINES

Propping of development workings and of the coal face is one of the most important processes of underground coal extraction. The cutting of development workings is carried out concurrently with the opening up of the coal seams to divide the seams into extraction sections and to provide ventilation. Development workings are vital arteries, which serve as routes for transport of coal extracted at the working faces and materials brought in, and for inflow and outflow of air. The present extent of supported development workings in mines of the Ministry of Coal Industry USSR exceeds 11,000 kilometers.

Extraction workings are formed with the removal of coal from seams lying at a great depth. These are occupied by the workers who extract coal as well as by various machines and other equipment. The total area of roof supported in extraction workings amounts to 1.5 million square meters.

The roofs of underground mine workings are under very great mine pressure, amounting to hundreds of tons for every square meter of exposed roof surface. The principles of the manifestation of mine pressure have been inadequately studied up to the present. Work along this line indicates the extreme complication of processes occurring in mine rock with the removal of



the coal. It has not been possible up to now to establish regularity in the start and development of mine pressure on the roof of underground workings. Hence, dependable and economical propping of underground workings is a very complicated technical task.

Coal mines are the largest consumers of wood in the country and annually use millions of cubic meters of mine timbers. In a number of instances, these timbers are brought from areas located thousands of kilometers from the coal regions.

The work of unloading the timber, preparing props from it, lowering the props into the mines, delivering them to the installation place, and installing them is very laborious. More than 20 percent of underground workers and more than 15 percent of those employed at the surface of mines are engaged in roof control, propping of working faces, propping and supporting of development workings, and delivery of timbers to the work place.

New Types of Props

A great deal of work has been done, particularly in postwar years, on designing new types of props with the aim of promoting safety of work in mines, reducing the laboriousness of mine propping, and decreasing consumption of timber in the coal industry.

Principal trends in designing new types of mine props are as follows:

Increasing the durability of wooden props by impregnating the wood with disinfectant compounds.

Replacing wooden props with more permanent and dependable metal props, which, unlike wooden props, may be used repeatedly.

Introducing reinforced concrete and concrete blocks as cheap substitutes for timbers.

Mechanizing the propping process and designing of mechanized, movable props.

Work is being carried out along all these lines and notable results have been achieved. One of the important measures for curtailing the consumption of timbers and reducing consumption of labor and capital is the lengthening of the period of service of the propping timbers. The underground workings of mines are characterized by the high moisture and relatively high temperature of the air. This creates a favorable condition for the activity of fungus which causes the wood to decay and collapse. In a number of cases, mine timbers have been completely destroyed in the course of several months. Special installations for impregnating mine timbers with water solutions of sodium fluoride and zinc chloride have now come into extensive use. Impregnating timbers with these disinfectants makes it possible, according to preliminary data, to increase the length of service of the timbers from two to three times.

In postwar years, designers and inventors have designed a whole series of new types of props. Concrete blocks are being used more and more extensively for propping capital workings. Since 1947, metal props have been widely employed for supporting development workings. The production of sectional metal frames of special rolled iron has been mastered. At present, more than 1,000 kilometers of the most crucial mine workings, with a long term of service, are supported by such frames. Reinforced concrete tubular props are supporting more than 550 kilometers of development workings.

New Props Widely Used

New types of props have received wide industrial use. By the end of 1953, more than 850 faces, or 36 percent of the total number in mines in slightly dipping seams, were propped with metal props, organpipe props, or "kostry." [The last is special propping at the face, consisting of ordinary propping frames joined together in the form of a square or triangle and going from the floor to the roof of the worked-out seam. They are stable and at the same time flexible.] More than 2,200 kilometers, or 16 percent of the entire extent of supported development workings, are propped with metal frames, reinforced concrete frames, concrete blocks, or timbers impregnated with disinfectants.

By 1955, it is planned to raise the number of faces with metal propping to 1,150. The extent of mine workings propped with metal and reinforced concrete frames or timbers impregnated with disinfectants is to exceed 3,200 kilometers, or 22 percent of the entire extent of supported workings as against 7 percent at the end of 1950.

The number of types of metal props has increased considerably to allow for the execution of the planned works. In 1950, the USSR had only one type of frame, the SGK, but different types of metal frames now have been designed to meet almost all conditions of coal extraction at the working faces.

However, it is necessary to keep in mind that the introduction of new types of propping still does not mean mechanization of the process of propping. The installation and transfer of props remain laborious.

Mechanization Directed

The directives of the 19th Party Congress on the Fifth Five-Year Plan set before the coal industry the task of introducing on a broad scale mechanized methods of propping faces. Actually, work on mechanizing methods for propping faces has been underway for a number of years. This task is extraordinarily complex; the props at the face must withstand enormous pressure from the above-lying rock and, at the same time, the area in which mechanized propping equipment must be placed is extremely limited.

In recent years, as the result of persistent, creative work by both scientific research and designing organizations and also by individual inventors, the solution of the problem of creating mechanized props has been realized. The designing, manufacture, and testing of several types of such mechanized props are now being carried out.

At the suggestion of workers of the Gukovugol' Trust of the Rostovugol' Combine, the MPK mechanized, movable prop was developed and manufactured for Donbass mines. This is made up of a row of individual, wedge-shaped telescopic frames, to which cantilever top pieces are welded. In the area between the mass of the face and the row of frames are placed the combine, the conveyer, and the mechanism for transferring the prop. In experiments with the MPK prop, used in a set with a Donbass combine and a flexible SK-20 conveyer in Mine No 20 of the Gukovugol' Trust, good results were obtained.

The Shch-52 prop, designed for Moscow basin mines, was intended to support the roof and to protect the working area from obstruction from crumbling or falling rock. The Shch-52 consists of individual sections joined together. When blasting has been completed on one strip of coal, the shield is moved along the face with the aid of special winches. Shield Shch-52 withstood industrial experiments successfully in Mine No 3 of the Tulaugol' Combine. Now three such shields are in operation in Moscow basin mines.

Both types of mechanized movable props still have a number of imperfections in their design and are in need of further improvement.

IV. COAL CLEANING

During the war and postwar years, a new branch of industry was created, namely, the mechanized cleaning and briquetting of coal. Processing of run-of-the-mine coal in cleaning plants reached a volume 2.6 times as great in 1950 as in 1940.

In 1949, there were no coal-cleaning plants in the Kuzbass. Now all coking coal extracted in Kuzbass mines is subjected to mechanical cleaning. In Karaganda, the volume of coal cleaning in 1950 was at three times the 1940 level and in 1955 it will increase another five times. [It is not clear from the Russian whether 1940 or 1950 is the basis for comparison in this last figure.]

The scope of coal cleaning is indicated by the fact that every year about 250,000 tons of rock are removed from coal in cleaning plants and that more than 200 trains would be required for the transport of this rock. Concurrently with this increase in the processing of run-of-the-mine coal, the quality of coal (concentrate) shipped from coal-cleaning plants has steadily improved.

In enterprises of the coal industry, a new method of cleaning coal fines has found wide use. This is the flotation method, which sharp decreases losses of high-grade coking coal contained in sludge. In 1953, more than one million additional tons of coking coal of short-supply types were cleaned in flotation installations of the Donbass. Flotation has also begun to be employed in Karaganda and will be practiced soon in the Kuzbass and Georgia.

Sulfur and Ash Removal

Soviet specialists are the first in the world to design and construct an experimental-industrial installation for removing sulfur and ash from coal by chemical-gravity methods. Introduction of this method will lead to a considerable increase in the supplies of coking coal, both as a result of cleaning coal with a high sulfur content, which was formerly not desulfurized, and from intensified desulfurization of coal in operating coal-cleaning plants.

Mechanized methods of cleaning lignite have also been mastered.

The technological process of coal-cleaning plants is improving steadily. During recent years, automatization of control of the technological process has been more and more widely introduced. Old low-capacity machines have been replaced by new, highly productive equipment. For the classification and dehydration of coal, new USSR-made machines have been designed and are at present installed in all coal-cleaning plants and sorting installations. More than 300 such machines are in use. Perfected pistonless jigging machines have replaced old piston machines for coal cleaning.

Questions of coal cleaning are acquiring particularly great importance in connection with the introduction of mining machinery of a new type, the coal mining combine. Rocky layers and inclusions in the coal are crushed together with the coal by the combine and their removal from the coal is difficult. In a number of cases, particularly in mines extracting coking coal, introduction of combines is checked by the absence of the necessary coal-cleaning installations. In this connection, during the Fifth Five-Year Plan, particular

attention will be paid to the construction of coal-cleaning plants expressly for mines which utilize combines.

In accordance with the directives of the 19th Party Congress, the volume of coal cleaning will be increased considerably. In 1955, processing of run-of-the-mine coal will be at 3.2 times the level of 1950, and the number of coal-cleaning plants will be 8.5 times that of 1940.

The volume of coal briquetting is increasing steadily.

V. STATISTICAL EXCERPTS

In 1953, the level of mechanized loading in sinking vertical shafts amounted to 82.3 percent and in constructing horizontal workings, 37.6 percent. The level of mechanized coal loading at the face amounted to 27 percent, while 43 percent of all horizontal main development workings were cut with mechanized loading.

The 1953 increase over 1951 amounted to 49.5 percent in the rate of sinking vertical shafts, 78 percent in cutting haulage passages with blasting of rock, 48 percent for crosscuts and field passages, and 88 percent for slopes.

As a result of the use of loading machines and development work combines, the level of mechanized cutting of mine workings will be 3.3 times as high in 1955 as in 1950. For the chief coal basins, mechanization of this process will be practically completed amounting to 80 percent in the Donbass, 97 percent in the Kuzbass, and 80 percent in Karaganda.

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